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      A      RRRR      PPPP      A      N      N      EEEE      TTTT
      A A      R      R      P      P      A A      NN      N      E      T
      A      A      RRRR      PPPP      A      A      N      N      N      EEE      T
      A A A A      R      R      P      A A A A      N      NN      E      T
      A      A      R      R      P      A      A      N      N      EEEE      T

      N      N      EEEE      W      W      SSSS
      NN      N      E      W      W      S
      N N N      EEE      W      W      W      SSSS
      N      NN      E      W      W      W      W      S
      N      N      EEEE      WW      WW      SSSS
  
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Issue 9

November 1973

ARPA Network Information Center
 Stanford Research Institute
 Menlo Park, Calif. 94303

ARPANET NEWS The Monthly Online/Hardcopy ARPANET Newsmagazine
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The online version is sent to all Network members who receive online delivery from NIC. It can also be accessed by anyone who logs into SRI-ARC and uses the query language named NIC.

The online version contains the month's basic issue. Each week a branch is added, containing items received during the week. This update material is added to the new feature articles to produce the next month's issue.

For scanning on TTY:

control c
nic CR
a/rpanet news/ CR
s/how/ (whatever you choose from the contents) CR
(to stop printing) control o (to exit) q/uit/ CR
(to show statement numbers) v/:type View specs:/ MG CR

For printing NEWS:

nls CR
L(OAD) F(ILE) <nic>arpanews CR CR (for current)
or
l/load/ f/file/ <nic>arpanewsOctober CR CR (for earlier)
or
l/load/ f/file/ <nic>arpanewsup CR CR (for UPDATES only)
o/utput d/evice t/eletype/ CR

One hardcopy of the monthly issue will be sent to each Liaison, Principal Investigator, and Station Agent at Network Sites, and to Network Associates. Local reproduction is encouraged.

Contributions to the NEWS may be forwarded to JI at NIC through the Journal, to ISELI@USC-ISI, or to Jean Iseli, The MITRE Corporation, National Systems Design Dept. Westgate Research Park, McLean, Va. 22101. News may also be forwarded to JBN through the NIC Journal, or mailed to Jeanne North at SRI.

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CALENDAR Events of Network Interest

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3

Schedule

3a

11/5-7 IEEE Conf on Systems, Man & Cybernetics
 11/7-8 Sym on High Level Language Computer Arch
 11/12-13 2nd Texas Conf on Computing Systems
 11/12-16 Image Processing
 11/13-15 DATA-SYMP
 11/27-30 +DECUS Fall Symposium
 1/8-10 74 HAWAII-CON
 2/12-14 74 2nd Ann Computer Science Conference
 4/22-23 74 Workshop on Machine-Independent Graphics
 5/6-10 74 NCC 1974 National Computer Conference
 6/17-19 74 IEEE Intl Conf on Communications ICC74
 7/15-17 74 +Conf on Comp Graphics

Meetings marked "+" are new listings with more information given below. Others have been announced in previous issues.

3b

Conference on Computer Graphics and Interactive
Techniques, July 15-17, 1974, University of Colorado

3c

This will be a formal conference with papers later published in the Journal of Computers and Graphics or in the proceedings. Ira Cotton will chair a session on Graphics and Networks, Jim George of Colorado State University will chair a session on Standards, and Andy van Dam of Brown University is planning one on Division of Labor between Central and Satellite Computers. Robert Schiffman of the University of Colorado, Boulder Colorado 80302, is the Conference General Chairman, and Jon Meads of Tektronix, Delivery Station 81-872, Box 500, Beaverton, Oregon 97005, is the Program Chairman. Contact any of these if you have suggestions or wish to submit a paper.

... excerpted by JBN from Network Graphics Note 4, Nic 19474

DECUS 1973 Fall Symposium, November 27-30, Hyatt Regency, San Francisco.

3d

Attendees will register for Mini/midi computer sessions, or for Decsystem-10 sessions. Advance registrations are to be made with DECUS, 146 Main St., Maynard, Mass. 01754. Fee: \$45 or \$60 member, \$50 or \$65 nonmember. Daily registration \$17 and \$20.

ARTICLES

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STATUS REPORT on the TERMINAL IMP

(This status report assumes the distribution of
Software Release 316 which in some cases is still
Pending)

.....Alex A. McKenzie /BBN-NET/

The first Terminal IMP (TIP) was delivered to the field in late
1971. At the end of October 1973, nineteen TIPs were operational
within the network at the following sites:

NASA, Ames Research Center, Moffett Field, California
University of Hawaii, Honolulu, Hawaii
University of Southern California, Los Angeles
Fleet Numerical Weather Central, Monterey, California
Tymshare Data Services, Cupertino, California
Range Measurements Laboratory, Cocoa Beach, Florida
University of Utah, Salt Lake City, Utah
Air Force Global Weather Central, Lincoln, Nebraska
U.S. Department of Commerce, Boulder, Colorado
University of London, London, England
Norwegian Seismic Array, Kjellar, Norway
Seismic Data Analysis Center, Washington, D.C.
MITRE Corporation, Washington, D.C.
Advanced Research Projects Agency, Washington, D.C.
U.S. Air Force Environmental Technical Applications Center,
Washington, D.C.
National Bureau of Standards, Washington, D.C.
Computer Corporation of America, Cambridge, Massachusetts
Rome Air Development Center, New York
Wright-Patterson Air Force Base, Ohio

Further, TIPs are imminently scheduled for delivery to Rutgers
University and Kirtland Air Force base, and a TIP is to be
installed at Bolt Beranek and Newman for service to the user
community in the Boston area. Given the proliferation of TIPs
over the past two years, the fact that TIPs account for a large
portion of the network's traffic, and the fact that the TIP
software development effort is reaching a plateau, it seems
appropriate to give a complete status report on the TIP effort.

STATUS REPORT on the TERMINAL IMP (cont)

1. Fabrication, Installation and Maintenance

The TIP is fabricated by BBN by combining a Multi-Line Controller with a 316 IMP. The former is constructed by BBN, the latter by Honeywell. Completed systems are extensively tested both off and on the network before shipment to the field. TIPs are installed by a BBN field engineer with the help of a Honeywell field engineer. The BBN field engineer also aids site personnel in connecting Hosts and data sets to the TIP. Once installed, the TIP is under a Honeywell maintenance contract although BBN engineers are regularly sent to the field to help with difficult problems. In practice the basic Multi-line Controller has proven to be almost 100% free from failure although there have been failures of Line Interface Units, the modules to which terminals or data sets are connected.

All TIPs in the network are configured with at least 28 kilowords of core memory of which 16 kilowords is dedicated to the IMP and the remainder is dedicated to the TIP. Two TIPs have been delivered with a magnetic tape option and these have an additional 4 kilowords of memory (or 32 kilowords total). The Wright-Patterson machine and most future TIPs will have 32 kilowords of core as Honeywell now manufactures only 8-kiloword banks of memory.

At present all TIPs have at least one Host interface although this is only used at about half the TIP sites. Two Host interfaces are possible at present, and this will be expanded to three at some time in the future. A TIP can handle up to 63 modem and terminal devices.

2. Documentation and the TIP Users Group

In addition to numerous informal and working publications to date, five formal publications about the TIP have been written. These are:

BBN Report 2183, "User's Guide to the Terminal IMP" (kept current through updates). A guide to using a TIP from a terminal, including discussion of how to make a logical connection to a Host and how to operate the TIP magnetic tape option.

BBN Report 2184, "Hardware Manual for the BBN Terminal Interface Message Processor" (October 1972). A complete hardware logic description of the Multi-Line Controller (limited distribution).

STATUS REPORT on the TERMINAL IMP (cont)

BBN Report 2277, "Specifications for the Interconnection of Terminals and the Terminal IMP" (kept current through updates). The description of how to connect modems and terminals to the Line Interface Units of the TIP's Multi-Line Controller (limited distribution).

S. Ornstein, F. Heart, W. Crowther, H. Rising, S. Russell, and A. Michel, "The Terminal IMP for the ARPA Computer Network". Proceedings of AFIPS 1972 Spring Joint Computer Conference, Vol. 40, pp. 243-254 (May 1972).

N. Mimno, B. Cosell, D. Walden, S. Butterfield, and J. Levin, "TERMINAL Access to the ARPA Network -- Experience and Improvements", PROCEEDINGS OF THE Seventh Annual IEEE Computer Society International Conference (COMPCON 73), pp. 39-43 (February 1973).

The most important source of informal TIP documentation is the TIP User's Group Note series. Notes in this series are published in a timely fashion and are primarily used to warn users of impending system changes and to poll users as to their desires for future improvements. These notes, as well as TIP User's Guide updates, are distributed directly or through site representatives to all TIP users. We estimate that there are presently between 700 and 1000 TIP users, from Hawaii to Norway.

3. Terminal and Modem Handling Capabilities

The TIP presently assumes all terminals use 8 bit characters except IBM 2741s; although TIP hardware exists to vary this, the TIP software does not presently allow variation. The TIP allows the following modem and terminal rates when they are clocked internally to the TIP: 75 bps, 110 bps, 134.5 bps, 150 bps, 300 bps, 600 bps, 1200 bps, 1800 bps, 2400 bps, 4800 bps, 9600 bps, and 19200 bps. Speeds in excess of 2400 bps are supported for output only.

The following rates are allowed when clocked externally to the TIP: any rate up to 3.3 Kbs for input or output, and any rate from 3.3 to 19.2 Kbs for input only.

The TIP handles a variety of terminal and modem types as listed below.

STATUS REPORT on the TERMINAL IMP (cont)

3.1 Terminals (see footnote [1] below)

- KSR-33 Teletype compatible terminals; i.e., ASCII terminals without requirement for special timing or parity calculations.
- KSR-37 Teletype compatible terminals; i.e., ASCII terminals requiring even parity output.
- ODEC Printer; an ASCII printer requiring special timing considerations.
- MEMOREX Printer; an ASCII printer requiring special timing considerations.
- Execuport compatible terminals; i.e., Teletype compatible terminal requiring special timing for a slow carriage return and line feed.
- IBM PTTC and Correspondence 2741 compatible terminals; i.e., EBCDIC terminals with the 2741 transmit and receive interrupt options but requiring a special line turnaround protocol.

There are a large number of terminals compatible or "almost compatible" with those listed above; many of these have been used with the TIP by various groups. The TIP does not handle remote job entry terminals or other terminals requiring complex protocols.

3.2 Modems

The TIP will work with the appropriate options of Bell 103 or 113 series modems up to 300 baud. Specifically included are the Vadic equivalents of the Bell modems.

Above 300 baud fewer options exist. For 4-wire, private line, full duplex operation, the Bell 202R, and (if properly configured) the 202D may be used up to 1800 baud. The 202C is intended for two-wire dial up use and, since it is a half duplex device, will not work with the TIP. The Supervisory-channel version provides only a 5-baud reverse path which is of no use to the TIP. With certain cross-connections, a simplex device (such as a line printer) can be run with a 202C but the complexity and the software constraints cause us not to recommend it.

STATUS REPORT on the TERMINAL IMP (cont)

No Bell modem exists for 1200 baud dial-up operation. The only such modems known to us are the Vadic 3400 series, which have been tested by BBN and seem to work as advertised. They are available with many strap options, including a set which handles the 103 protocol, allowing direct replacement in the case of devices which are now using the 103 and are limited by transmission speed.

Several manufacturers sell (or advertise) dial-up modems which provide 1200 baud transmission in one direction and 110 or 150 in the other. In concept, this is an obvious choice for CRT terminals. However, evaluation of many of these units has led us to be extremely cautious. Those that malfunctioned tended to have few problems with their modulators or demodulators, but frequently failed to establish connections due to inadequate hand-shaking-protocol logic.

In December or January a report summarizing the specific problems and solutions of the various modem choices will be issued to TIP users.

Recently BBN implemented a complete modem "hang up" protocol which is required for use of automatic-answer 103 modems connected to some central switching offices (the TIP previously relied on hang-up procedure originating in the carrier's central office, but not all central offices originate this procedure). In addition, the "hunt" bit for a port can no longer be altered by a dial-in user.

STATUS REPORT on the TERMINAL IMP (cont)

4. Magnetic Tape Option

Significant modifications have been made to the magnetic tape option since it was originally developed. The major characteristics of the option as it now exists are listed below:

- The TIP magnetic tape option follows a simple, efficient, robust, but ad hoc protocol.
- A tape transfer will "ride through" the destruction of a message or even a network partition for an extended period without data loss (assuming that the source and destination TIPS SURVIVE FOR THE DURATION OF THE TRANSFER).
- The tape option uses the network optimally with respect to throughput by allowing multiple messages to be simultaneously in transit.
- The tape option uses messages optimally by packing $2 \frac{2}{3}$ 6-bit bytes into every 16 bit word transferred.
- The maximum size record which can be handled is currently 2400 frames (7-track tape); this maximum is tailored to the user's requirements.
- The option is in routine use between GWC and ETAC for the transfer of two tapes every day. It also will soon be in daily use between GWC and AFCRL via Lincoln Labs.

5. Use of the Resource Sharing Executive (RSEXEC)

The TIPS now make extensive use of the TENEX RSEXEC [2]. The TENEX RSEXEC currently is run on many network TENEX systems and a package (called TIPSER) which allows direct TIP use of the TENEX RSEXEC runs on BBN-TENEX, ISI-TENEX, and will soon run on the SRI-ARC TENEX.

STATUS REPORT on the TERMINAL IMP (cont)

TIP use of RSEXEC is presently initiated by the TIP user command @N [3]. This initiates a broadcast of a TIP message to all network RSEXECs running TIPSER. A connection is made between the TIP and the first RSEXEC to respond. Over this connection, the TIP user can access a number of useful services. At the present time these are:

- A "NETNEWS" service which allows the IMP and TIP system programmers and the NCC staff to communicate to users. The headline of the latest news is typed immediately on connection to TIPSER.

- A "GRIPE" service which allows users to communicate to the IMP and TIP system programmers and to the NCC staff.

- A "HOSTAT" service which reports which Hosts in the network are up and available.

A "LINK" service which allows a TIP user to make a two-way connection between his terminal and any user of a TENEX system running RSEXEC.

- A "SNDMSG" service which provides a general purpose "mail" distribution facility.

- A "TRMINF" service which gives the TIP user information about his terminal including the name of the TIP he is using and the TIP MLC port to which his terminal is attached.

- More than seventeen other services (commands) are presently available to the TIP user through TIPSER. Included are text editing (e.g., delete character, delete line, retype line) and terminal control (e.g., full duplex, set attention character) commands, as well as commands for finding other network users, finding an unloaded server TENEX, and commands which help in learning to use the RSEXEC.

We plan to continue expanding the facilities available to TIP users through the RSEXEC. Most immediately, we plan to add a facility which will give users news relating specifically to the TIP they are using, such as an announcement of an updated preventative maintenance period for the TIP. This will also include a facility which permits the site person responsible for the TIP to add a site specific news item and edit out old news items. Other facilities which will eventually exist via RSEXEC are:

STATUS REPORT on the TERMINAL IMP (cont)

- on-line access to the TIP User's Guide and other documents such as the Resource Notebook.
- TIP passwords, access control, and accounting
- generalization of the LINK and SNDMSG services to allow addressing of other TIP users as well as Host users.
- a READMAIL service which allows TIP users to receive mail independent of any server Host.
- an expanded TRMINF service to provide TIP status (e.g., number of users on TIP, load average).
- a distributed virtual file system for TIP users.

6. Software Improvements

Since the installation of the first TIP in the field, hundreds of improvements have been made in the TIP software system. Since July 1972 the changes visible to users have been documented in a series of "Letters to TIP Users" published as RFCs and TIP Users Group Notes [4]. Consequently, we will not describe the software development to date [5]. We will, however, list a few of what we think are the most important upcoming software changes:

- The TIP logger will be made re-entrant.
- The new TELNET protocol will be implemented -- this and the previous task are highest priority and should be done by early in 1974.
- The TIP's handling of terminals will be extended to the simulation of tabs and formfeeds, handling of line and page overflow (especially for CRT terminals), motor control, X-ON/X-OFF handling, and using a reverse channel for "Go Ahead."
- Improvement of TIP messages to the user.
- Making various TIP options yet more modular.

STATUS REPORT on the TERMINAL IMP (cont)

7. Bandwidth Capabilities

The TIP can physically handle 63 terminals and data sets. A recent recalculation of the TIP bandwidth indicates that there has been little decrease in the total bandwidth which may pass through the TIP to and from its 63 terminals. The maximum terminal traffic is still about 80 Kbs (e.g., eight 9600 bps CRT terminals doing only output [6]). The maximum total TIP throughput of Hosts, wideband lines, and terminals is still about 600 Kbs full duplex and must satisfy the inequality

$$H+L+15T < 600 \text{ Kbs}$$

where H, L, and T are full duplex Host, line, and terminal traffic respectively (e.g., a 50 Kbs line with full traffic in both directions counts as only 50 Kbs).

Footnotes

[1] In addition to those listed below, at BBN we have a heavy duty Data-Products printer connected to the TIP, in a manner which requires no special software, through a special interface which provides an external clock to the TIP at maximum rate.

[2] R. Thomas, "A Resource Sharing Executive for the ARPANET", Proceedings of the AFIPS 1973 National Computer Conference and Exposition, Vol 42, pp. 155-163 (June 1973).

[3] Later this may be made automatic.

[4] RFCs 365 and 386, and TIPUG Notes 5, 8, 12, 13, 14, and 19.

[5] Perhaps the most important change in the software is in the area of increased adapta Assuming sufficient buffer space is available and that no special software timing or parity calculations are necessary.

ARPANET USERS Interest Group Charter

USING Note #6
NIC 19025

J. Iseli (MITRE-TIP)
D. Crocker (UCLA-NMC)
N. Neigus (BBN-NET)

4b

BACKGROUND

The ARPANET Users Interest Group (NIC Ident = USING) was formed at a meeting of 15 Network people on May 23, 1973 in an attempt to improve the Network user's working environment. USING will attempt to represent the interests and needs of users in the Network community, so as to increase awareness of user requirements and encourage better provision of the needed services. The group believes that the Network is moving beyond a concentration of resources in self-perpetuating research and development; the Network is becoming a service and its viability as such is dependent on user satisfaction.

A second group, the ARPANET Users Group (NIC Ident = USERS) is organized as a forum for users to express their desires and complaints. Acting as a steering committee and lobby for this group, USING will forward their ideas to the appropriate centers.

MEMBERSHIP

Group membership, in USING, is open to individuals interested in working to improve Network user support and able and willing to make meaningful contributions to USING's activities.

Membership, in USERS, is open to any interested person.

SCOPE

USING has set as its scope those facets of Network activity that affect the provision of services to users. This includes the availability of resources, their reliability and ease of use.

ARPANET USERS Interest Group Charter (cont)

GOALS

USING's overall goal is to ensure that the ARPANET becomes a coherent system in which users can regulate their own working environment according to their level of experience and the degree of transparency (of specific system idiosyncracies) they desire. System resources should be self-documenting, and all levels of assistance (on- and off-line) should be available, again, to be regulated by the user.

Short Term Objectives, for the initial 6-12 months

1. Specification of a user-level Common Command Language (CCL);
2. Specification of a Network Editor for CCL;
3. Further definition and focusing of User Issues;
4. Encouraging establishment of a User's consulting service;
5. Publication of a New-Users Handbook.

Long Term Activities

1. Monitor and/or provide impetus for user-oriented Network development efforts, including resource directories, tutorials [static and dynamic], training courses and referral services;
2. Provide mechanisms to encourage, analyze, and respond to user feedback;
3. Develop profile information relative to users' requirements, types, usage attributes, and affiliations;
4. Stimulate mechanisms to facilitate entry of new users to the ARPANET;
5. Sponsor user seminars and encourage formation of viable user working groups where appropriate.

An ONLINE INTERVIEW with DR. FRANK KUO

4C

Following is an online interview conducted 25 October 1973 by Jean Iseli, MITRE-TIP, Editor of the ARPANET Newsletter, with Dr. Frank Kuo of the ALOHA System, University of Hawaii, author of the featured site article on the ALOHA System in this issue.

ji: Dr. Kuo, can anything be said at this time relative to tentative or firm plans for when the BCC 500 system will be available on the ARPANET? Let me defer till last the several questions I wanted to ask about your work in satellite communications.

FFK: NOT REALLY. THE 500 IS NOT YET ON THE NETWORK AS A HOST. WE EXPECT THAT IT WILL BE EQUIPPED WITH AN NCP AROUND THE END OF THE YEAR. AS YOU KNOW, THE MACHINE IS MOSTLY AN EXPERIMENTAL MACHINE. AT LEAST, IT IS A ONE OF A KIND. THUS WE HAVE THE USUAL SERIOUS PROBLEMS WITH REGARD TO DISTRIBUTION OF DOCUMENTATION, ETC., WHICH MAKES IT DIFFICULT TO ACCOMMODATE NUMBERS OF USERS ALL OVER THE NETWORK. CERTAINLY, IT MUCH EASIER FOR TENEX TO FACE THIS PROBLEM. ALL WE CAN REALLY SAY NOW IS SOMETIME AROUND THE FIRST OF THE YEAR.

ji: I can well understand that. Could you maybe tell us a little bit about the type of network users you might, when the machine is available on the Net, like to see employ it. My understanding is that it contains many unusual and forefront features.

FFK: THANKS FOR THE COMPLIMENT...BUT TO A USER IT LOOKS LIKE MANY OF THE OTHER SYSTEMS NOW ON THE NETWORK. ITS COMMAND LANGUAGE STRUCTURE LOOKS SOMEWHAT LIKE TENEX'S (ALTHOUGH IT IS DIFFERENT, OF COURSE) AND OTHER THAN THAT, WELL IT JUST COMPUTES. ALL OF THE REALLY FANCY FEATURES RELATE TO THE SYSTEM ARCHITECTURE, AND THE USER HAS NO WAY OF TELLING THAT WHEN HE IS ON LINE. IT WILL RUN OLD XDS 940 SOFTWARE AND IT DOES ACCOMMODATE SPL, A SYSTEMS PROGRAMMING LANGUAGE DEVELOPED BY PETER DEUTSCH AND BUTLER LAMPSON SEVERAL YEARS AGO WHEN THEY WERE AT BCC. OTHER THAN THAT, THE SPL LANGUAGE RESEMBLES OTHER LANGUAGES NOW AVAILABLE (SAIL, BLISS, ETC.)

ji: Would it be fair to represent that the BCC 500 will then be a general server to the Net?

An ONLINE INTERVIEW with DR. FRANK KUO (cont)

FFK: PROBABLY NOT. WE WOULD LIKE TO SEE IT USED BY A NUMBER OF PEOPLE, OF COURSE, BUT IT IS DIFFICULT TO SUPPORT THE PUBLIC AT LARGE. IT WILL BE USED BY A SELECTED NUMBER WHO IN SOME SENSE WORK CLOSELY WITH US OR OTHERWISE SOMEHOW KNOW HOW TO USE IT. FOR NOW AND FOR THE NEXT SEVERAL MONTHS, IT MUST BE CONSIDERED ONLY FOR "FOOLING AROUND".

ji: The reason for my interest on this point is that, as you may know, we assist ARPA in helping new network users satisfy their interest in the network. We have found that an understanding of the status of a site, relative to its desire for general network users, is mandatory to avoid much unnecessary confusion and embarrassment. Aside from the interests you mentioned in the fine article that you and Wayne submitted to us, are there other categories of interest or areas of collaboration that might be mentioned to better characterize for our readership, the ALOHA system, and in particular the BCC 500 intended user community?

FFK: THE BCC 500 WILL BE USED PRIMARILY BY THE PEOPLE AT NASA AMES AND XEROX PARC WHO ARE FAMILIAR WITH THE XDS 940. IT WILL BE USED AS A RESEARCH MACHINE FOR OUR WORK ON SYSTEM SECURITY. IT IS TOO EARLY YET TO DESCRIBE THIS WORK, AS THIS IS AN AREA THAT WE ARE JUST MOVING INTO IN SUPPORT OF THE DEVELOPMENT OF THE ILLIAC SYSTEM. MEL PIRTLE AND WAYNE LICHTENBERGER ARE WORKING VERY CLOSELY ON THIS PROBLEM, WHICH IS JUST IN THE DEFINITION STAGE NOW. I CAN SAY QUITE A BIT MORE ABOUT THE WORK OF TASK 1 IF YOU WISH TO PROCEED NOW.

ji: Fine, your article prompted several questions about the broad and powerful implications of the work you are doing in satellite communications. Maybe I could just ask a few preliminary questions first to broaden our understanding: (1) The function of your MENEHUNE communications computer -- could you maybe amplify in this area a little, and (2) the "link" you mentioned to the University of Alaska, and other possible links; will that also provide access to ARPANET resources to these existing and proposed "links"?

An ONLINE INTERVIEW with DR. FRANK KUO (cont)

FFK: THE MENEHUNE FUNCTIONS MUCH LIKE AN IMP ON A RADIO CHANNEL INSTEAD OF LEASED LINES. IT HAS BUFFERING, ERROR DETECTION, ACKNOWLEDGEMENT, TIMEOUT, PACKET ASSEMBLING AND DISASSEMBLING CAPABILITIES. THE MACHINE ITSELF IS A 16K HP 2100; 8K IS DEDICATED TO THE RADIO CHANNEL AND 8K IS TO BE USED FOR OUR MINI-NCP WHICH IS BEING WRITTEN AND DEBUGGED NOW. WHEN THE NCP IS COMPLETED BY THE END OF THIS YEAR, THE USERS OF THE RADIO CHANNEL CAN ACCESS THE ARPANET THROUGH THE REGULAR ALOHA RADIO CHANNEL. SINCE THE MENEHUNE TREATS THE SATELLITE USERS ON THE ATS-1 AS ANY OTHER USER, ATS-1 USERS CAN ACCESS THE ARPANET VIA OUR MENEHUNE. HOWEVER, WE MUST GET PERMISSION FROM ARPA FOR OUTSIDE (ATS-1 USERS) TO ACCESS ANY PARTICULAR SYSTEM. WE'LL FACE THAT WHEN WE GET ALL CONNECTED.

ji: Is my understanding correct in the following:
(1) The MENEHUNE computer will be interconnected to the ARPANET, (2) The MENEHUNE computer is also much like a TIP in that it will contain an NCP; and (3) The MENEHUNE will, in a manner of speaking, provide potential access to ARPANET resources (given that appropriate issues are ironed out) for the ALOHA user community?

FFK: THE MENEHUNE WILL BE CONNECTED TO THE ARPANET THROUGH A HOST PORT ON THE HAWAII TIP. THE OTHER HOST ON THE TIP WILL BE THE BCC 500. THUS THE HAWAII TIP WILL ENABLE ALOHA RADIO CHANNEL USERS TO ACCESS BOTH THE ARPANET AND THE BCC 500.

ji: What I find so exciting in the work you are doing is the terrific potential for economically distributing access to the many benefits inherent in an ARPANET to a global community. Remote areas, with the inexpensive ground station you mention in the article, can avail themselves of network resources without the significant expense of communication lines and necessity for local IMPS/TIPS or costly alternatives.

FFK: YOU'VE SAID IT ALL. I'D JUST LIKE TO ADD A POINT. WE ARE IN DAILY VOICE CONTACT VIA ATS-1 WITH FIJI, NEW ZEALAND, ALASKA, AUSTRALIA, AND NASA AMES. ONCE WE PROVIDE THESE FACILITIES WITH PROTOTYPES OF OUR MENEHUNE (DOCUMENTS AND BLUEPRINTS, MAINLY) THEY CAN BE ON THE AIR SENDING DATA. THE HP2100 SYSTEM PLUS THE TCU'S COST IS LESS THAN HALF OF A TIP. THIS IS WHERE THE REAL BREAKTHROUGH WILL COME. FOR THE PEOPLE WHO ARE UNFAMILIAR WITH THE TECHNICAL ISSUES OF SATELLITE BROADCASTING ON AN ALOHA CHANNEL, I REFER THEM TO THE PAPERS IN THE 73 NCC PROCEEDINGS BY ABRAMSON, KLEINROCK AND ROBERTS.

An ONLINE INTERVIEW with DR. FRANK KUO (cont)

ji: Dr. Kuo, I want to thank you very, VERY much for the real and RARE delight of sharing this discussion with you.

FFK: THANK YOU FOR THE OPPORTUNITY TO DISCUSS OUR WORK.

ji: One more question, please. Would you consider a member of your staff writing a summary of the forthcoming session in Hawaii, the network subconference. I believe our readership would be most interested in that.

FFK: NORM ABRAMSON IS CHAIRMAN OF THE SUBCONFERENCE. INCIDENTALLY, VINT CERF AND BOB KAHN WILL ALSO BE HERE THEN FOR AN INWG MEETING. SO I ENCOURAGE ALL MEMBERS OF THE ARPA NETWORK COMMUNITY TO COME FOR THESE TWO EXCITING MEETINGS.

ji: Fine, I will contact Norm. Thank you again, Frank.

FEATURED SITES

=====

CARNEGIE-MELLON COMPUTER SCIENCE DEPARTMENT

By

Howard Wactler for
Allen Newell

5

5a

The Computer Science Department evolved as a graduate education and research department of the university in 1965. The research pursued spans the entire spectrum of computer science, emphasis varying with changing interests of the faculty. The computing facility is based around two PDP-10 processors whose system embellishments support the research needs. This service is complemented by an engineering lab facility staffed with eleven full-time engineers and technicians that enables us to support efforts from speech understanding to (multi)processor design and measurement. Our efforts are funded by a collection of grants, gifts, and contracts, the largest being with ARPA/IPT.

RESEARCH INTERESTS

Reflecting the interests of faculty and students, our efforts include artificial intelligence, speech and visual recognition, operating systems, programming languages and system building systems, graphics, complexity theory, numerical analysis, performance measurement, and the design of computer hardware systems. We select just three of these for mention below.

C.mmp and Hydra

The CMU multi-mini processor is constructed around a set of up to 16 PDP-11 computers, connected through a crosspoint switch to a large sharable memory of up to 2^{120} words. The present configuration has grown to three processors and four memory ports; the operation of the 16 X 16 switch is anticipated by January. The kernel of the operating system, named Hydra, is running on the PDP-10 and portions are now functioning on the prototype system being driven by test programs. Hydra is built in BLISS, which is an implementation language on the PDP-10 that produces object code for either the PDP-10 or PDP-11. It is intended that this processor will be significant in satisfying the real-time I/O and processing requirements of the speech understanding system and other similar network computational needs. It provides as well a fertile environment for our research in computer structures, operating system design, interprocess and processor communication and measurement.

CARNEGIE-MELLON (cont)

Speech Understanding System

The Hearsay system is operational on our PDP-10's and has been demonstrated live at several workshops. The system utilizes simultaneous analysis of context, syntax and semantics in a speech recognition task in a limited domain. Its continuing improvement with evolving heuristics and programming techniques is being measured and charted. There is significant interaction and data sharing with other network sites engaged in similar efforts. The needs of this project have spurred the development of a high performance intelligent video terminal (50,000 vectors/sec) for monitoring the system performance and the XCRIBL system for hard copy, raster scan, computer output of arbitrary type font text, graphics and half-tone images on the Xerox Graphics Printer for recording it?

Artificial Intelligence

Work is proceeding in this area on several fronts, many closely related to work in human cognition. Automatic protocol analysis programs (PAS-II) exist to transform human verbal behavior to problem behavior graphs (a trace of how the human solves the problem). There is work on production systems, which are composed of productions (a condition and an action) and a collection of data structures for encoding the information upon which the productions act. Productions systems are being used both to explore the structure of the human immediate processor and as a general form of programming system for understanding programs. Other work continues on understanding systems, with MERLIN as the vehicle for investigation. Chess also continues to be a serious research endeavor. Many of these programs were constructed with L*, a system building kernel language on the PDP-10, presently being bootstrapped for the PDP-11.

FACILITY

Two independent PDP-10 KALO's running embellished DEC "10/50" systems complemented by DEC, Stanford and CMU language processors provide the base of our service. Presently, the two machines communicate with each other only over the network. We expect to soon add C.mmp and the university's 360/67 and 1108 as additional hosts on our IMP. Both of our systems have approximately 200K of memory, 600K swapping space and 40 million words of disk storage.

CARNEGIE-MELLON (cont)

One system (10A) is considered the general user machine with 40 terminal lines and 20 hour per day scheduled user uptime. The alternate system (10B) supports all the specialized speech and vision hardware, mountable private disk structures and specialized terminals, and thus serves as the primary machine for those engaged in sensory perception research. The same machine is used for system development and experimentation therefore having scheduled downtimes and a less stable performance.

Our system provides TELNET, FTP and MAIL service but only a limited set of HELP functions presently exists. Expected in the first quarter of 1974, a specialized hardware interface between PDP-10's and PDP-11's (C.mmp) will provide for data transfers at estimated rates of 5 megabits/sec while at the same time giving us the means for implementing a common communications front end for all our systems. It is anticipated that such a front end will eventually alleviate the PDP-10's and C.mmp of much of the lowest level IMP-network service burden.

Usage information is available from S300HW09@CMU-10A via FTP mail or through the NIC to ident HDW.

The ALOHA System

5b

By

Franklin F. Kuo

The ALOHA System is composed of a related series of contracts and grants from a variety of funding agencies with principal support from ARPA, which deal with two main themes: computer communications (TASK 1), and computer structures (TASK 2).

Under computer-communications there is work in (a) studies on computer-communications using radio and satellites; (b) the development of a prototype radio-linked timesharing network; (c) system studies and planning for a Pacific area computer communications network linking major universities in the U.S., Japan, Australia and other Pacific countries.

Under computer structures, we are engaged in research/development in multiprocessor computing structures, computer networks, and geographically distributed computing systems. This work is being undertaken in two phases: (1) the establishment of a research facility, and (2) the research work itself. The research facility is centered around the BCC 500 computing system.

TASK 1: Radio Communications

Developments in remote access computing during the latter part of the 1960's have resulted in increasing importance of remote timesharing, remote job entry and networking for large information processing systems. The present generation of computer-communication systems is based on the use of leased or dial-up common carrier facilities, primarily wire connections. Under many conditions such communication facilities offer the best possible communications option to the overall system designer of a large computer-communication facility. In other circumstances, however, the organization of common carrier data communication systems seriously limits the possibilities of a large information processing system.

Since September 1968, the ALOHA System Project at the University of Hawaii has investigated alternatives to the use of conventional wire communications in a geographically diffuse computer system. When the constraint of data communications by wire is eliminated a number of options for different methods of organizing data communications within a computer-communications net are made available to the system designer. The ALOHA System Project has investigated the use of a new and simple form of random access communications for a statewide university computing system; the first links in this UHF radio-linked computer system, were set up in mid-1971.

Since that time the ALOHA System has been in continuous operation. The ALOHA network uses two 24,000 baud channels at 407.350 MHz and at 413.475 MHz in the upper UHF band. ALOHA uses packet switching techniques similar to that employed by the ARPANET, in conjunction with a novel form of random-access radio-channel multiplexing.

We are now developing a Phase II ALOHA network with mini- and micro-computers as programmable terminals and repeaters. This effort is part of the work undertaken by the Packet Radio Group under the direction of Robert E. Kahn of ARPA. In conjunction with the hardware development we are also conducting system studies on the effects of different channel protocols upon system performance and also on the properties of the random-access channel (known now as the ALOHA Channel) used in different modes.

TASK 1: Satellite Communications

We are now conducting experiments on the effective uses of high capacity satellite channels for packet switched communications. The experiments are centered around the geosynchronous satellites ATS-1 of NASA and INTELSAT IV of COMSAT.

With the development of new digital communications systems by COMSAT in which data at the rate of 50 kbaud can be transmitted through a single voice channel, data transmission by satellite has become both technologically and economically realizable. During the past year we have initiated two specific research projects for satellite extension of the ALOHA System and several theoretical studies involving the unique properties of satellite channels. The first of the projects involves the use of large commercial ground stations and the establishment of an ARPANET SATELLITE SYSTEM; the second involves the use of small inexpensive ground stations in a joint research effort with NASA Ames Research Center. In regard to the ARPANET SATELLITE SYSTEM we have been involved in a joint study with ARPA, BBN, UCLA, and Xerox PARC to design a suitable protocol for packet communications via satellite.

The ALOHA System (cont)

In December 1972, a 50 kilobaud data channel using a single PCM voice channel was installed between the COMSAT ground stations at Paumalu, Hawaii, and Jamesburg, California. The first subscriber of this service was ARPA for the inclusion of the ALOHA System into the ARPANET. The BCC 500 computer is planned to be the main HOST of the Hawaii TIP. We are also planning to connect the MENEHUNE (the communications computer for the ALOHA Net) as the second HOST.

The second satellite project involves the use of the NASA satellite ATS-1 using small inexpensive ground stations which cost less than \$5,000 each. Thus far we have progressed to the point where an ALOHA random access burst mode channel is in operation between the University of Hawaii, NASA/AMES Research Center and the University of Alaska. During the following year we plan to interface this channel into computer near each of these ground stations, extend the number of ground stations to other sites, including possibly universities in Japan (Tohoku), Australia (Sydney), and other Pacific countries and establish a small ground station satellite network on an experimental basis.

We are also studying the possibility of using a complete transponder on a U.S. domestic satellite for ARPA Network operation. Such a transponder might provide megabit or higher rates using a transponder dedicated to packet switched operation and terminating in a large number of moderately priced ground stations at a cost of only a fraction of the expected land line costs by the end of 1974. In addition to the lower costs and higher speeds, a packet switched transponder on a domestic satellite would provide for higher network connectivity and enhanced possibilities for new forms of resource sharing.

TASK 2: Background

Task II of the ALOHA System is concerned with multiprocessor computing structures and systems. Its primary research facility is the large BCC 500 system which was brought from Berkeley, California when the Berkeley Computer Corporation ceased activities.

The main ideas involved in the 500's design were formulated by Project GENIE at UC Berkeley during 1967 and 1968. At that time it was planned that a private company would participate with UC in a joint design effort for a multi-user computing system designed expressly for online activities. This arrangement did not work well, however, and in early 1969 a number of persons from the project left UC and formed BCC with the specific goal of building a working prototype of a similar system.

The ALOHA System (cont)

This effort came to an end two years later when, with the nation's economy in a severe recession and the entire computing industry in an accompanying "adjustment", the company ran out of available development capital a few months short of its goal of producing income on its prototype. The system itself, however, was almost complete and had been running an operating system for six months.

The equipment was acquired by the University of Hawaii upon the formation of Task II and was brought to Honolulu in early 1972. Since that time much of the Task's efforts have been directed to setting up the system once again and reconstructing some of the hardware after careful analysis of its state. Software development has also been done since the system has been locally usable beginning in March, 1973. By December 1973 the system will achieve full host status on the ARPANET and will be operated regularly. By virtue of the time difference between Hawaii and the mainland -- especially the East Coast -- the system might be especially attractive for browsers.

TASK 2: BCC 500 System

The system hardware includes two central processors and five special purpose processors, 128K 24-bit words of central memory (i.e., visible to all processors), 32K words of additional memory connected to some of the special purpose processors, 4 million words of drum storage (transferring at 2 megawords/sec, or 6 megabytes/sec) and 380 megabytes of disk storage. The central processors are provided each with memory maps giving them the ability to address 256K words of paged, virtual memory of which half is available for user programs.

The special purpose processors implement those portions of the operating system which are concerned with global system tasks. These include memory management -- central memory allocation, dynamic drum allocation, disk allocation and all page traffic between these devices; character input/output -- to and from terminals including the handling of break and/or wakeup characters and remote echo strategies; central processor scheduling; and the NCP process for network protocol handling. Those operating system functions which are oriented toward the individual user process, i.e., which can be done by calls from the user process not requiring its blocking, are performed on the CPU's in a conventional manner. The systems code for these functions resides in one of two hardware-implemented system rings (a third ring permits the user to process to run while permitting the system full protection from it).

The ALOHA System (cont)

All the system software is written in SPL, a systems-programming language developed by BCC for operating systems and utility subsystems (like compilers). There is no assembly language. All compiled code is reentrant and sharable between tasks.

The CPU's have a special mode selectable in their state word which permits them to execute XDS 940 machine language directly. A utility program, called the 940 Emulator, is available to all users and operates in conjunction with 940 programs, serving to translate 940 system calls which are otherwise trapped into equivalent sequences of 500 system calls. In this fashion all available 940 software will run on the 500 system.

We will welcome your online exploration of our system as it assumes host status and direct your attention particularly to the SPL language. Please address your questions and comments to: Wayne Lichtenberger, 486 Holmes Hall, University of Hawaii, 2540 Dole Street, Honolulu, Hawaii 96822.

PROTOCOLS
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TELNET Implementation Schedule

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The New TELNET (NIC 18639 and NIC 18640) is scheduled to go into effect on 1 January 1974.

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The new FTP (NIC 17760) is scheduled to go into effect 1 February 1974.

The User sitting at his terminal should not notice the changeover, and will not have to do anything different.
.....Jon Postel

Updated TELNET Option

6D

A completely updated version of 18492, Remote Controlled Transmission and Echoing TELNET Option, has been issued by D. Crocker and J. Postel as NIC 19859. The corrections are pointed up in NIC 19860, issued as RFC 581., and will be distributed by NIC to holders of the Protocol Notebook.

RESOURCE NEWS
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TRAFFIC STATISTICS for September 1973

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Network Liaisons have received RFC 579 by Alex McKenzie, NIC 18801, which gives Host throughput statistics for September, showing the traffic for each Host. Internode traffic totalled 86,793,910 packets, intranode traffic was 22,282,380, giving daily averages of 2,893,130 and 742,746 respectively. Packets/messages (internode) was 1.07.

ABSTRACTS OF RECENT NETWORK DOCUMENTS

..... Prepared by Mil Jernigan

W. Michael Lay, David L. Mills, Marvin V. Zelkowitz (University of Maryland, Computer Science Center, College Park, Maryland). Design of a Distributed Computer Network for Resource Sharing. In: AIAA Proceedings, Computer Network Systems Conference, Huntsville, Alabama, 16-18 April 1973. Paper 73-426. 7p. NIC 18602.

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A distributed operating system for an integrated network of minicomputers is proposed. This system provides the network resources and controls the sharing of these resources by using blocks of virtual memory called segments. Segments can be used for programs and data, and can be transmitted as messages between processes. Processes are given capabilities to influence their own environment, as well as that of other processes, through standard message communication procedures. The network design allows processes to be location independent so that they need not be aware of the hardware configuration (possibly distributed over several sites) upon which they execute.

Julius S. Aronofsky (Southern Methodist University, Dallas, Texas). National Networks for Education. In: AIAA Proceedings, Computer Network Systems Conference, Huntsville, Alabama, 16-18 April 1973. Paper 73-419. 5p. NIC 18600.

A discussion of the trend towards regional and national educational computer networks as a means of progress on three levels of academic community involvement: (1) hardware/software research for non-university users; (2) instruction of students and their preparation for coping with the impact of computers on society; (3) optimum use of computers as part of educational technology. A commentary is given on some recent publications and also comments on a series of EDUCOM sponsored meetings. Future directions are discussed.

IRICON, International Information Service via Computer Oriented Network. (ITALCABLE, Rome, Italy.) 12p. December 1972. NIC 18594.

Brochure describing the services, communications handling and tariff arrangements on the ITALCABLE store-and-forward, message switching computer network. The services possible for private networks and subscribers, computer utility services, traffic pattern logistics, quick retrieval of messages, leased channels and telex positions are described.

Benjamin J. Loret (Joint Technical Support Activity, Washington, D.C.). Prototype Worldwide Military Command and Control System Intercomputer Network. In: AIAA, Computer Network Systems Conference, Huntsville, Alabama, 16-18 April 1973. Paper 73-416. 9p. NIC 18606.

Experiments are being developed leading to specs for operationally linking the WWMCCS standard Honeywell 6000 series computers in 1970s. Network connectivity will use leased lines, four interconnected Honeywell 316 IMPs (one for network control, one for each computer). Experiments will include workload sharing concepts, system software and communications requirements, overall system responsiveness resulting from various data distribution strategies. Experiments, simulations, and communications/ADP tradeoff analyses will lead to definition of specs for ADP and communications hardware, software and interface.

E. Levin (System Development Corporation, Santa Monica, California). The Future Shock of Information Networks. In: AIAA Proceedings, Computer Network Systems Conference, Huntsville, Alabama, 16-18 April 1973. Paper 73-439. 10p. NIC 18605.

During the past five years the burgeoning growth of the large scale distributed computer processing systems tied together through an information network are being recognized as having an impact on our nation comparable to the recent great technological developments such as nuclear energy, supersonic aircraft, space flight, lasers and TV. In many ways, our daily lives will be altered to a greater extent by information networks than any other recent technology. Possibly the most dramatic changes will be a cashless society and a computerized government, although protection of individual rights is a deep concern. Greatest danger is one of insufficient policy rather than insufficient technology.

A. Shoshani, I. Spiegler (System Development Corporation, Santa Monica, California). The Integration of Data Management Systems on a Computer Network. In: AIAA Proceedings, Computer Network Systems Conference, Huntsville, Alabama, 16-18 April 1973. Paper 73-417. 8p. NIC 15717.

An approach is discussed to integrate data management systems on a computer network for the purpose of data sharing. Properties of the common language are explored, and a method of implementing the translation interfaces by a meta-compiler is described. More flexibility can be achieved by the use of a natural language processor. Some conclusions are drawn regarding the desirability and feasibility of this approach.

Eric F. Harlsem, Suzanne D. Landa (RAND Corporation, Santa Monica, California). VIEW: A Distributed System for Graphical Analysis of Large Data Bases. In: AIAA Proceedings, Computer Network Systems Conference, Huntsville, Alabama, April 16-18, 1973. Paper 73-431. 8p. NIC 18604.

The VIEW System is designed to aid researchers via graphical analysis of large, remotely-located data bases. In order to access remote data storage facilities (e.g., the trillion-bit Laser Store), modules of VIEW are distributed over the ARPANET, with the main analysis module on the UCLA 360/91. The user/system interface was designed to satisfy a set of user-generated specifications and to allow syntactically different inputs to remote data retrieval systems. Terminal input/output is in a Network standard format, allowing use of VIEW from any graphics terminal connected to the Network.

Stuart Wecker (Digital Equipment Corporation, Programming R&D, Maynard, Massachusetts). A Building Block Approach to Multi-Function Multiple Processor Operating Systems. In: AIAA Proceedings, Computer Network Systems Conference, Huntsville, Alabama, 16-18 April 1973. Paper 73-425. 9p. NIC 18601.

A description of the structure of a functionally flexible operating system created from building block modules. Independent communicating modules structure the functions and services, connected by an operating system base which provides the communication facilities. The functional modules communicate and synchronize their actions via explicit data exchanges over well-defined communication channels. This explicitness of communication allows for the independent movement of these modules within the system environment, making this structure suitable for multiple processor and computer network configurations.

Louis Pouzin (IRIA-Institut de Recherche en Informatique et Automatique, Rocquencourt, France). Presentation and Major Design Aspects of the CYCLADES Computer Network. Submitted for presentation at the Third Data Communications Symposium. 23p. April 1973. NIC 18256.

CYCLADES, a general purpose heterogeneous computer network launched in France in 1972, has as its purpose the construction of a prototype network to foster experiments in areas such as data communications, computer interactions, cooperative research, distributed data bases, in a realistic environment, with a variety of operational services acceptable to customer standards. Design is a carefully layered architecture, providing for an extensible structure of protocols and network services, tailored to various classes of traffic and applications.

Louis Pouzin (CYCLADES, Institut de Recherche en Informatique et Automatique - IRIA). INWG Note 35 - Efficiency of Full-Duplex Synchronous Data Link Procedures. 9p. June 1973. NIC 18255.

An examination of the efficacy of certain procedures for transmission, some of which claim to be full-duplex, but in actual practice, are not. An evaluation is made based on their ability to sustain a full speed traffic as offered by the bandwidth. This is of prime importance for computer-to-computer traffic, where line speed will be the major throttle and efficiency will be directly related to proper use of the bandwidth. It will be shown that the best procedures are a multiplexing of independent channels, while others are only a lame approximation of full duplex.

Alex Reid (Communications Studies Group, Joint Unit for Planning Research, University College London and London School of Economics). New Directions in Telecommunications Research: A Report Prepared for the Sloan Commission on Cable Communications. 62p. June 1971. NIC 18595.

Alternative criteria for future developments in person-person telecommunications are considered. Relevant allied areas discussed are information theory, applied and experimental psychology, management theory, sociology, urban and regional planning, geography, and human communication techniques. Future research is suggested in community communications, human aspects of telecommunications, rather than simply the needs of business firms. The psychological background of telecommunication as related to technology is explored.

D. K. Branstad (National Security Agency, Fort George G. Meade, Maryland). Security Aspects of Computer Networks. In: AIAA Proceedings, Computer Network Systems Conference, Huntsville, Alabama, 16-18 April 1973. Paper 73-427. 8p. NIC 18603.

Connecting various types of terminals and various computer systems in either geographically local or distributed networks creates many technical problems. Under consideration is the definition of the communication and switching requirements of a network of different computers, terminals, and users with various access authorizations. The general problem is described, as is the impact that security requirements have on a network, and some possible approaches to a solution.

PLANS
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No contents in this issue

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OTHER NEWS
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NET PEOPLE: Jon Postel relocates

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9a

Jon Postel (JBP) [Co-chairperson for Protocols (with Alex McKenzie of BBN)] has joined the technical staff at the MITRE Corporation. His new address is:

Jon Postel
The MITRE Corporation -W185
1820 Dolly Madison Blvd.
Westgate Research Park
McLean, Virginia 22101

His telephone number is: (703) 893-3500 Ext. 2350.

The primary task that Jon will be responsible for is the Evaluation of Network Control Programs.

.....Editor

OTHER NEWS (cont)
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TELENET APPLIES TO ESTABLISH NETWORK

9b

Telenet Communications Corp., a subsidiary of BBN, has filed an application with the FCC to establish and operate a "value-added" network based on the packet switching technology now being used in the ARPANET.

The system will use land-based and satellite communications channels leased from other carriers. Customers will connect their computers and terminals to Telenet switching centers.

Usage charges to customers will be based on the volume of data. The proposed rate charge favors high-volume users, with rates ranging from \$4 to \$0.48 per 1000 packets, depending on total monthly traffic for each subscriber computer. Night usage prices will be halved.

Computer connection links to Telenet will range from \$500 to \$4500 per month for leased lines of from 4800 to 50,000 bit/sec capacity.

Terminal connections will be priced on transmission speed, but customers may use either dial-in or dedicated lines. Dial-in use will cost from \$0.50 to \$2 per hour.

Dedicated terminal charges will range from \$50 to \$220 per month, depending on transmission speed, in addition to leased line cost.

Initially, there are to be IMPS and TIPS in 18 cities, to begin operation with in 18 to 21 months after an FCC permit.

....abstracted by JBN from Computerworld, 17 Oct, p.17.

FORUM
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No contributions in this issue.

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